Attachment B
Incentives to Repower Aging Wind Turbines in Europe

The repowering of aging wind plants in California may provide the dual benefits of increasing the state's renewable energy supply and reducing avian mortality. Despite interest by the California Energy Commission and California Public Utilities Commission in encouraging this repowering, and some efforts by the state's investor owned utilities, repowering activity has been slow. This is partly a reflection of the "California fix" embedded within the Federal production tax credit, which currently impedes repowering to some degree. It is also a reflection of the fact that many existing, aging wind facilities are more profitable operating under their existing QF contracts than they would be after project replacement.

To combat these barriers, it may be necessary and useful to consider a more proactive state policy to encourage repowering, one which would offer an explicit incentive for the repowering of aging wind projects. There are many ways that such a policy might be designed. This write-up does not address the full range of policy options, but instead simply summarizes related efforts in Denmark and Germany.

Denmark and Germany have enough aging wind projects to have a similar motivation as California's state agencies in encouraging project refurbishment and repowering. However, unlike California, both of these countries currently offer proactive policies intended to directly encourage such repowering.

Denmark

Denmark was the first country to actively support wind repowering, in part because wind turbine installation began in the early 1980s, so a large number of aging, small (< 75 kW) wind turbines exist throughout the country. Denmark recognized that these smaller, aging turbines were an obstacle to new project development, and that removing and repowering those turbines would require an overt and explicit incentive. Denmark's repowering program has led to the repowering of two-thirds of the oldest turbines in the country.

Denmark's first incentive program for repowering wind operated from April 2001 – December 2003. For turbines smaller than 100 kW, "repowering certificates" allowed owners to install three times the capacity removed and receive an additional feed-in tariff price of 2.3 cents/kWh for the first 12,000 full load hours (~5 years) of the enlarged wind project. For turbines in the 100-150 kW size range, owners could install twice the capacity removed and receive the same treatment.

As a result of this program, 1,480 turbines totaling 121.7 MW were replaced with 272 new turbines totaling 331.5 MW. Some owners of older wind projects also decided to decommission their projects and sell their repowering certificates to other wind developers.

Denmark has continued to encourage wind repowering through a policy enacted via the *Energy Policy Agreement* of March 2004. This new program intends to repower another 175 MW of aging wind turbines. Under the program, an extra surcharge is

paid for new, onshore wind-turbines on the condition that the owner has a repowering certificate for a wind turbine 450 kW or less decommissioned between December 2004 and December 2009. The surcharge is paid for factory-new wind turbines connected to the grid between January 2005 and December 2009. The surcharge amounts to 1.6 cents/kWh, and is paid for electricity production corresponding to 12,000 full-load hours for up to twice the decommissioned wind-turbine's installed power. The surcharge is regulated in relation to the market price of electricity, and the total of the surcharge and market price must not exceed a specified level. Because of the current low price of wholesale electricity, wind industry stakeholders in Denmark are concerned about the adequacy of this incentive and are calling for a larger incentive.

Germany

Germany's wind power boom started later than Denmark's. Repowering is expected to constitute a major part of the wind market in the years ahead, especially as available new sites for wind development continue to diminish. Stumbling blocks include local government restrictions on hub height or total turbine height and setback requirements between installations and residential areas. As of mid-2005, just 59 MW of wind turbines had been decommissioned, replaced with 169 MW of wind capacity. Despite the barriers, the wind repowering opportunity in Germany is enormous.

Before 2004, Germany's feed-in tariff provided some encouragement for wind repowering by offering new wind projects a higher payment than existing projects that had been operating for some time. Since 2004, the feed-in tariff has offered a longer and higher payment level to wind turbines that replace/modernize existing projects built before December 1995 and are at least three times the capacity of the repowered turbine.

Despite this incentive, repowering has just begun, and given the regulatory siting and permitting barriers to repowering identified above, the wind industry argues that the feed-in tariff repowering incentive is insufficient.